



PATRICIA ZUBER

MOLYBDENUM

Element Symbol: **Mo**

Atomic Number: **42**

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Nuclear-based science benefiting all Australians

Molybdenum is a silvery-white, high-melting metal. It does not react with oxygen or water at room temperature and it also resists corrosion at ordinary temperatures. Molybdenum is one of the five major refractory metals (metals with very high resistance to heat and water). The other refractory metals are tungsten, tantalum, rhenium and niobium. Molybdenum oxide (MoO_3) is soluble in alkaline water, forming molybdate salts.

Carl W. Scheele extracted molybdenum oxide from the mineral molybdenite (molybdena) in 1778. He concluded that the mineral contained a new element but did not isolate it. In 1781, Peter J. Hjelm isolated the metal by reducing the oxide with carbon. The element name comes from the Greek word 'molybdos', meaning lead.

Molybdenum is also recovered as a by-product of copper and tungsten mining operations. The metal is prepared from the powder made by the hydrogen reduction of purified molybdenic trioxide or ammonium molybdate.

Molybdenum is not found free in nature. The main ore of molybdenum is molybdenite, (molybdenum disulfide, MoS_2). It also occurs in wulfenite (lead molybdate) and powellite (calcium molybdate). Commercially, the metal is obtained by mining molybdenite directly.

Molybdenum's strength and resistance to expanding or softening at high temperatures is particularly sought after in critical areas where high temperatures are common, such as in nuclear power plants and aircraft engines.

It is also used in the petroleum industry, to catalyse the removal of organic sulphur compounds in coal liquification and gas liquification processes. It is also used strongly in steel production, for example in 25% of all stainless steel.

Molybdenum is an essential element for animals and plants. As with selenium, too much of it is toxic, too little of it is fatal.

In nitrogen fixing bacteria, molybdenum is a vital component of the nitrogenase enzyme which allows conversion of nitrogen gas in air into nitrates vital for plant growth. Molybdenum is also present in 20 or so enzymes needed in animals' metabolisms.

The world molybdenum price soared in 2007, reaching a high of US\$76/kg from a low of about US\$10/kg in 2001 and is currently at around US\$32/kg. For almost 20 years the market has been stagnant, but has been transformed as a result of limited supplies and continued strong demand. China's high level of steel production and consumption has led to strong internal demand for molybdenum, reducing China's molybdenum exports and supporting the high prices. In Australia, feasibility studies or several projects were initiated because of higher prices.

Research has shown that Australian export thermal coal contains on average 0.8 mg Molybdenum per kilogram of thermal coal.

Provided by the element sponsor ANSTO

ARTISTS DESCRIPTION

I wanted to illustrate Molybdenum's high resistance to heat. It is used in electrical elements and as an orange pigment in ceramics. These applications and the colour of the element itself provided me with the palette for my print. I made a collagraph (textured) plate and printed it as a metallic background. An electrical element turned on its side created the capital M. I incorporated the lower case "o" and the numbers 42 into the design and cut the plate. I over printed a two colour blend to complete the image.

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